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ABSTRACT

In 1979, a Committee on Production Guidelines for Book Longevity was formed to study some aspects of the book preservation problem. Composed of representatives from libraries, publishing, and the paper industry, the committee set two primary objectives: to increase knowledge about the durability of books and other materials, and to encourage improvements in their physical properties. A survey of more than 430 publishing companies sought information on the use of acid-free paper, awareness of the need for permanent papers, and willingness to cooperate by identifying acid-free publications. The reports in this document and the survey were planned to serve a dual purpose--to gather information about the use of acid-free paper and durable bindings, and also to alert publishers, librarians, and others to the need for more careful consideration of production decisions. The "Report on Book Paper" discusses who has responsibility for preservation, what is currently being done, what should be done, availability of materials, recommendations, durability of books, the production situation, and paper mills. An appendix provides guidelines and a table of manufacturers producing acid-free grades of paper. "On Longevity in Book Bindings" includes information on pages, folded and gathered sheets, book covers, and recommendations. The members of the committee are listed. (THC)

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Book Longevity

Reports of the Committee on Production Guidelines for Book Longevity

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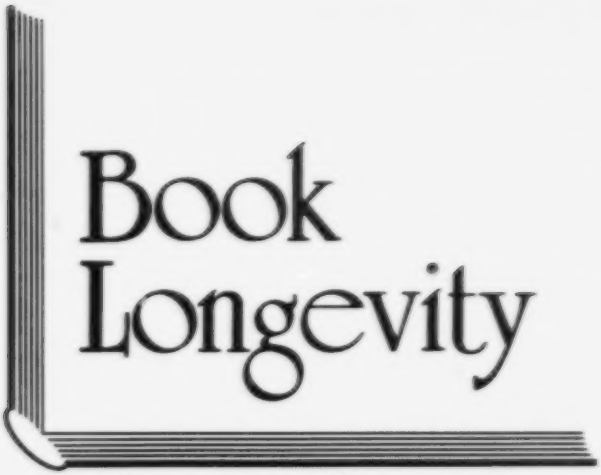

Reports of the Committee on
Production Guidelines for Book Longevity

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Introduction

Librarians, scholars, archivists and others who are concerned about preserving printed materials have long realized that the paper in books produced since the mid-nineteenth century is likely to become yellow and brittle with age, and eventually to disintegrate. There is also general public understanding and even alarm over what such decay implies—the loss of a large portion of the written record. Several aspects of the preservation problem deserve immediate attention—the technical, because there is as yet no widespread consensus on affordable methods and materials, and the economic and educational aspects, because if books continue to be manufactured as in the past, additional losses are inevitable. It is primarily the latter concern that has prompted the reports that follow.

In May, 1979, the Council on Library Resources, Inc., and the Andrew W. Mellon Foundation invited twenty individuals from the fields of publishing, paper manufacturing and preservation of library materials to a New York meeting to discuss aspects of the preservation problem. Following the meeting, a Committee on Production Guidelines for Book Longevity was formed to continue the discussions and to find ways to address the problem. Composed of representatives from libraries, publishing, and the paper industry, the Committee has worked for more than three years to collect information on paper and bindings and to understand better the technical, economic, and organizational considerations likely to influence the current and future production of books.

The Committee set two primary objectives: to increase knowledge about the durability of books and other materials, and to encourage improvements in their physical properties. Members began by preparing a statement on book paper, paying special attention to the need for and availability of durable paper and taking into account the varying purposes for which books are published and used. The group's preliminary findings were reported at a February, 1981 meeting held under the auspices of the Center for the Book at the Library of Congress. Following that meeting, a draft *Report on Book Paper* was completed and issued for comment. In its final form, the report contains the Committee's recommendations related to production and use of acid-free paper, and it includes technical information that characterizes permanent papers.

As they discussed paper durability, Committee members decided to obtain information on current practices of publishers regarding paper use. A survey of over 430 publishing companies sought information on the use of acid-free paper, awareness of the need for permanent papers, and willingness to cooperate by identifying acid-free publications. However, only 111 companies, or 25%, responded to the survey questionnaire. University presses provided a relatively large number of responses, with 46 of the 78 members of the Association of American University Presses (59%) returning questionnaires. Only 65 of the 359 commercial publishers surveyed (18%) provided information. Because most university presses and most of the commercial publishers that responded are aware of the need for long-lasting books, the survey results present a rather favorable picture of acid-free paper use—probably far more favorable than is actually the case.

In general, publishers' responses to the idea of using acid-free paper are influenced by the kinds of books they publish and the market they hope to reach; for example, most of the respondents indicated that they would not require acid-free stock for textbooks, paperbacks, and similar publications. More than three-fifths of those who responded are willing to include a statement identifying acid-free paper on the copyright pages of their new books. A few publishers commented that the Committee's report had brought the subject to their attention for the first time, and several added that they plan to obtain information concerning acid-free paper for use in future printing decisions.

After preparing the book paper report and survey, the Committee turned its attention to the topic of book bindings, focusing on binding durability, longevity, usability, and repairability. Numerous changes in binding technology during recent years, lack of research on binding longevity, and the wide variety of materials available made the task of constructing guidelines for evaluating bindings a complicated one. For example, adhesive bindings are less expensive than other binding methods, and consequently their use is increasing, but the compatibility of adhesives and the methods of application have not been systematically evaluated. Consequently, a major recommendation in the report is that further information on the longevity of binding materials be compiled by an independent organization.

The Committee's work has been based on the premise that no single group—librarians, paper manufacturers, or publishers—is responsible for the preservation problem or for the solutions. Rather, the current situation is the result of a lack of systematic procedures and guidelines, a dearth of information, and insufficient communication. The reports and the survey were planned to serve a dual purpose—to gather information about the use of acid-free paper and durable bindings, and also to alert publishers, librarians and others to the need for more careful consideration of production decisions. The survey results reveal the difficulty of communicating the Committee's concerns and influencing changes, although it does appear that some companies will alter their current practices if they are given sufficient information on requirements of libraries. Librarians and others concerned about preservation have the responsibility to exert their influence among those who are likely to make such changes and to specify their requirements for longer-lasting books.

Even though the work of the Committee has ended with the production of the two reports, there are many other prospects for further and effective national action on preservation. Much has been accomplished by other agencies and individuals since 1979. To cite two examples, the Library of Congress is now developing a comprehensive preservation program which emphasizes deacidification processes, and a subcommittee on standards for permanent papers has been organized within the American National Standards Institute. If discussion, research, and communication concerning book paper and binding continues at the present level, the Committee will have succeeded in its task.

Report on Book Paper

In the past few years there has been increasing awareness that millions of books and other documents all over the world are disintegrating. We are in danger of losing more than a century of the human record—since the early 19th century when paper manufacturers began the widespread use of processes that left acidic residues in paper. Such residues in the presence of light, heat, moisture, and air hasten the process of deterioration of the cellulose fiber, thus weakening the paper. For example, over six million volumes in the Library of Congress are now so brittle that their survival is threatened. Much effort has been expended, with very modest success, to devise economical ways of preserving these books. Much more needs to be done.

Our concern here is not with preserving the books of the past, but rather those of the future. Books containing the acidic seeds of their own destruction continue to be produced by the millions, storing up problems for the future, failing to provide a permanent record of our own times.

Our Committee on Production Guidelines for Book Longevity was formed by the Council on Library Resources, with help from the Mellon Foundation, to seek ways to encourage the production of publications that will last, especially books. We recognize that this is a herculean task. It would be useless for us to ignore economic forces; recommendations for improvement must stand the harsh test of the marketplace. Nevertheless, as we shall explain, we are optimistic. Some technological factors are working for us. Much can be accomplished through more awareness, through good will, and through cooperation, without adding substantially or even at all to the cost of many books.

Who's to blame? The public has awarded the largest share of blame for our present situation to the paper manufacturers, but are they at fault? Have they not, with enormous investment, met the demand of publishers for low-cost book paper, and has not this availability led to the huge expansion of reading? Until thirty years ago paper mills were not able to produce acid-free book paper at competitive prices, but now they can. Others say that poor paper standards are the fault of the publishers, but publishers have met the need of the public for low-priced books, and until recently few complained about paper permanence. The problem has been recognized since the 1950's, and even today librarians, who worry about prices and about preservation of old books, seldom ask about the structural quality of what they buy. Permanence was not a conscious part of book production decision-making. The problem is big and complicated; no one group *is* to blame, and exigencies of the day tend to push the problem aside to be dealt with by the librarians and the readers of the future.

What is being done? Actually, without a major effort, the situation is improving gradually. For reasons having nothing to do with permanence, the processes for making acid-free book paper were developed in the 1940's. Although the problem of disintegrating books was recognized much earlier, not until the Barrow reports of 25 years ago did publishers pay any attention. At that time, in response to a brief outcry from librarians, several publishers announced that henceforth they would use only acid-free paper. But lack of com-

mitment and shortages in supply caused the practice to be abandoned except by a few publishers. Recently both economic forces and the antipollution laws have increased interest in acid-free paper production. The trend is slow because the necessary technological changes are expensive (a large new paper machine costs more than $100,000,000), but it appears that in another decade the effects may be substantial. We estimate that in 1980 about 25% of paper manufactured in America for use in book production was acid-free (about 225,000 tons of a total of 840,000). This percentage will probably increase by 1990. Can we hasten this transition? In the long term, production responds to demand.

It should be recognized, however, that there are some strong opposing forces, especially the increasing use of groundwood, primarily in mass-market paperbacks and some textbooks. This use may be extended to other books too. Groundwood in any amount causes paper to deteriorate quickly. It is our hope that the increasing use of acid-free paper will offset the use of groundwood papers for books that need preserving. There is more groundwood paper, but there is also more acid-free paper.

What ought to be done? Should all book production, to say nothing of all other publications, be produced on "permanent" paper? That seems absurd. Much printed matter is made to be read and thrown away—newspapers, magazines, paperbacks. If they could be made permanent at no extra cost, no one would object, but it hardly seems reasonable to insist that they be manufactured to last for centuries. To the extent that they are wanted, other ways will have to be found to preserve them, probably mainly by microphotography. Much the same could be said of many books, though with hardbound books it becomes more difficult to make distinctions. Even the most ephemeral popular books (like magazines and newspapers) are part of the record of our civilization and will be of interest to future generations. Still, distinctions can be made. Many books—especially scientific and scholarly books and serious works of fiction and non-fiction—are culturally valuable and must be preserved in some form.

At a recent meeting of librarians, publishers, and paper manufacturers it was suggested that the following categories of books ought especially to be printed on acid-free paper: *primary printed sources, important works of fiction and nonfiction, collected editions, bibliographies, guides to collections, yearbooks, gazetteers, scholarly periodicals and monographs, dictionaries, encyclopedias, and other reference books.*

With some trepidation it was suggested that the following categories need not be on acid-free paper: *workbooks, textbooks, anthologies, vanity publications, athletic and political hagiography, popularizations in all fields, novelizations of films, formula novels, and most paperbacks.*

These lists cannot be definitive, but they can indicate directions. Ultimately publishers will have to make judgments. *The aims of our committee would be largely realized if publishers would be more aware of the need for "permanence" and would make thoughtful decisions about the paper used to print their books.* Publishers are proud of their books; they have the knowledge to make such judgments.

They should remember, too, that not only libraries want "permanent" books. Book lovers of all kinds have a right to expect, when they buy an expensive art book or children's book or novel, that it will not disintegrate.

Cost. Acid-free paper *need not be more expensive* than acidic paper of the quality normally used in hardbound books.

Availability. The paper industry is huge; only a little over 1% of its total production is book publishing paper. Hence the book industry can have very little influence on the paper industry as a whole. Moreover only a portion of book paper is used for hardbound books; we have already acknowledged that most paperbacks are by definition ephemeral. So, in seeking paper that will last we are concerned with a relatively small amount of production which can be supplied perhaps by fewer than ten companies. Publishers should use present acid-free production wisely, and we need to encourage the development of more acid-free mills. In recent years the demand for paper has risen, and book paper has sometimes been in short supply. In such conditions publishers will use what they can get. The supply in the next five years promises to be better.

Recommendations. Table I supplies information on the products of manufacturers producing acid-free paper. We offer guidelines that we think are desirable and economically reasonable, and we encourage publishers who follow the guidelines to make an appropriate statement to appear just below the copyright line. We suggest, for example:

> The paper in this book meets the guidelines for permanence and durability of the Committee on Production Guidelines for Book Longevity of the Council on Library Resources.

Identification of acid-free books is important because book-buyers, especially librarians, need to know which books may require special care in the future or special storage conditions now. Libraries spend millions on preservation; often it is necessary to microfilm books to preserve their contents. To the extent that acid-free books are identified, these procedures will be less costly. Funds saved could be used to enlarge collections.

We encourage libraries to make their needs heard, especially to those publishers producing books that are purchased mainly by libraries, and also to general publishers. The library market is significant to every hardback book publisher. The American Library Association should encourage publishers to produce long-lasting books.

The U.S. Government is the largest publisher in the United States, and nearly all of its productions are on highly acidic paper. We encourage libraries to make their voices heard to the Joint Committee on Printing and to other government agencies issuing documentary publications of long-range importance. The American Library Association, the Association of Research Libraries, and other such groups should offer their services in helping to determine which categories of publications should be issued in permanent form.

Durability. Until now we have spoken only of chemical disintegration. Books also fall apart for other reasons. Book papers need not only "permanence" but "durability," the ability to withstand folding and tearing. Without going into detail here, we shall recommend guidelines for minimum folding and tearing qualities. In a later report we shall discuss binding materials, which are obviously important too. But here we have focused attention only on the inside of a book, essentially its paper, because if that disintegrates, a long-lasting binding is superfluous.

Production realities. Publishers do not usually buy paper for an individual title. They buy paper by the carload or in minimum quantities of perhaps 10,000 pounds, in standard sizes, for use in a variety of books as needed. The production of *groups of books*, all in the same trim size and with identical paper, will be arranged for economy in printing and binding. Under these conditions a publisher cannot usually choose a particular sheet for a particular book. He carries a stock of several different sheets in a few different sizes and makes his choice for each book from among these. *We urge publishers, and especially their production managers, to stock at least some acid-free sheets for use on appropriate groups of books.*

Mills. The largest mills routinely producing acid-free paper at competitive prices are Warren, Glatfelter, and (for lightweight paper) Olin. There are also a number of smaller mills (no mill is small) producing good acid-free sheets, often specialty sheets for art books and the like. Table I in the Appendix lists acid-free mills and some of the sheets they produce. Publishers are urged to refer to this table when purchasing paper.

April, 1981.

Appendix

Guidelines. Although there are unresolved technical arguments about the validity of artificial aging tests, everyone agrees that acid causes paper to disintegrate. A pH of 7 is neutral;[1] a higher pH is alkaline while a lower pH is acidic. A pH slightly higher than 7 is desirable because the pH of paper tends to become lower and more acid over time due to chemical processes. Papers containing groundwood should be avoided entirely since groundwood deteriorates rapidly. Other characteristics of paper (opacity, printability, flexibility, etc.) may be affected by acid content, but we are confident that for any publication requiring permanence a suitable sheet can be found, without excessive cost, within the following guidelines:[2]

- Minimum pH of 7.5 (cold extraction, Tappi T 509)
- Minimum cross-direction folding endurance of 30 double folds at 1 kg. tension (25 replicates, Tappi T-511)
- Minimum average machine direction tear resistance: (Elemendorf, 10 replicates, 8-ply tears, Tappi T-414) of 70 grams
- Minimum alkaline reserve (calcium or magnesium carbonate or both) of 2% based on oven dry weight
- This standard applies specifically to uncoated 60 lb. paper (basis 25 x 36/60) or 90 gm./m^2.
- The paper should be made of cotton or fully bleached wood pulp (or a mixture) and should include no unbleached wood pulp or groundwood.
- No acid or chloride printing inks should be used.

Most books are printed on uncoated paper. Regardless of the weight, the pH factor should be maintained. For a given quality of papermaking materials, lower weight will mean less resistance to tearing and less endurance in folding. Depending on expected use, reduced folding and tearing characteristics may be tolerable.

The question of coated paper is not treated separately in this report. Modern coatings in general have a helpful effect on permanence, but pH standards should nevertheless be maintained. Fold and tear-test guidelines as given above apply to uncoated paper only.

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[1]pH is a symbol denoting the negative logarithm of the hydrogen ion concentration, in grams per liter, of a solution; it expresses relative alkalinity and acidity. The concentration of the free hydrogen ions is expressed as an exponent, so that pH4 is ten times more acidic than pH5 and one hundred times more acidic than pH6.

[2]These guidelines are adapted and simplified from the standards set by the National Historical Publications and Records Commission, the Library of Congress, and from the ASTM/ANSI Standard Specification for Bond and Ledger Papers for Permanent Records.

(Revised 1/4/82)

Table 1

PUBLISHING PAPER TABLE—ACID-FREE GRADES[1]

1. Grades for General Publishing

Paper manufacturer and location	Type of Paper	Shades	Available Surfaces
S. D. Warren Div., Scott Paper Co. Westbrook, Me. Muskegon, Mich.	uncoated	white cream	antique eggshell machine finish
	coated	white cream*	gloss dull
	coated	white	matte
P. H. Glatfelter Co. Spring Grove, Pa. Neenah, Wis.	uncoated	white cream	antique eggshell machine finish
	coated	white	gloss matte
Finch Pruyn & Co. Glens Falls, N.Y.	uncoated	white cream	special order only
Allied Paper Mills Div., SCM Corp. Kalamazoo, Mich.	uncoated lightweight	white cream	special order only
Olin Corporation Fine Paper and Film Div. Pisgah Forest, N.C.	uncoated lightweight	white natural	machine finish supercalendered
Miami Paper Co. West Carrolton, Ohio	uncoated	white cream	antique eggshell
	film coated	white	matte
Consolidated Papers, Inc. Wisconsin Rapids, Wis.	coated	white	gloss dull matte

2. Grades for Special Purpose Publishing
(regularly made or inventoried)†

Curtis Paper Company Newark, Delaware	uncoated	white natural	antique
Howard Paper Company Dayton, Ohio	uncoated	white natural	antique
Mohawk Paper Mills Cohoes, N.Y.	uncoated	white soft white ivory	eggshell
Monadnock Paper Mills Bennington, New Hampshire	uncoated	white natural	antique eggshell smooth

*Available certain items only.

†Generally heavier weights, and made on smaller, slower papermaking equipment; suitable for specialized uses, but not generally economically feasible for commercial publishing.

[1]The above is for informational purposes only, and is not to be considered an endorsement or recommendation.

Grades of paper or their makers listed in this table are those ordinarily used for trade, text, reference or scholarly book publishing. No attempt has been made to include papers permanent in nature ordinarily used for other purposes (e.g., record keeping) but unsuitable for book publishing use.

Only those paper manufacturers have been listed who make neutral or alkaline grades as part of a regular product line. Such papers are often available on special order, especially in the case of those suitable for special purpose publishing.

The paper industry continues to evolve in its use of raw materials and processes, and additions to this table, especially in the face of increased demand, are possible.

Definitions

antique—the roughest surface of uncoated paper normally used in publishing, consequently the bulkiest paper per inch.

coated—paper to whose surface a coating of clay, calcium carbonate or other pigment or mixture of pigments has been added to provide a smoother base for printing.

- ***dull***—coated paper whose surface has been left unpolished or has been otherwise treated to provide a non-reflective appearance for better readability or contrast with gloss inks.
- ***gloss***—coated paper that has been supercalendered (polished) for smoothness. Shiny in appearance.
- ***matte***—a type of coated paper carrying less surface coat weight than dull. Has a non-reflective surface, neither as smooth nor as refined as dull coated.

color—hue or shade, as distinguished from brightness. White, for this purpose, means that the underlying shade of the paper is toward the cold, or blue, end of the spectrum. Paper made with a yellow cast and whose underlying shade is toward the warm, or red, end of the spectrum is variously called natural or (darker) cream, or in some cases, ivory.

eggshell—not as rough as antique and less bulky, but still possessing a noticeable degree of texture.

groundwood—pulp produced by mechanically defibering wood without chemical cooking. The resulting high-yield pulp contains many impurities, notably lignin, which deteriorates markedly on exposure to light and air.

lightweight—a loose term describing paper lighter than 45 lb. (25 x 38 basis) or 67 grams per square meter. Heavily opacified; used for reference books, dictionaries, Bibles, etc. Sometimes called "Bible paper" or "thin paper".

machine finish—a "natural" finish as paper comes off the paper machine with only a modest attempt at compacting the web at the machine calender. Smooth to the touch.

supercalendered—paper that has been run through a series of polishing rolls (supercalender) off the paper machine. Very smooth and slick to the touch. Gloss coated paper generally has been supercalendered, and plain paper may be treated in this way.

uncoated—paper whose surface is not covered by clay or other material; also called "plain" paper.

On Longevity in Book Binding

In May, 1981 our Committee released its preliminary report on paper longevity, hoping that publishers would choose paper of lasting quality (acid-free) for books of expected long-term interest. The report was published in full in *Publishers Weekly*, May 29, 1981. A survey of publishers in January 1982 showed an increased consciousness of the problem of paper longevity. Of those reporting 67% of university presses (which sell primarily to libraries) and 21% of other publishers produced all their hardback books on acid-free paper, and others are considering changing their policies on paper use. A full analysis of the survey is available from the Council on Library Resources.

The present report is concerned with the longevity of bindings. In what follows we refer exclusively to adult hardbound books; it is assumed that paperbacks by definition are not meant to be long-lasting or to stand hard use. Bindings of books for juveniles, which have special requirements, are also outside the scope of this report.

In general we urge publishers to take account of the need for longevity in bindings just as we did in our report on paper. There we encouraged publishers themselves to make judgments on the need for longevity, and we reported that at a recent conference it was suggested that the following categories of books ought especially to be produced in permanent form: primary printed sources, important works of fiction and nonfiction, collected editions, bibliographies, guides to collections, yearbooks, gazetteers, scholarly periodicals and monographs, dictionaries, encyclopedias, and other reference books. With some trepidation we also suggested that the following categories need *not* be in permanent form: workbooks, textbooks, anthologies, vanity publications, athletic and political hagiography, popularizations in all fields, novelizations of films, formula novels, and most paperbacks.

The question of longevity in binding has proved to be a much more complex subject than in paper, partly because there have been important recent changes in binding technology, partly because there has been so little research on the longevity of bindings, and partly because there are so many different parts of a binding and so many different materials used. Thus our first recommendation is that systematic accumulation of information on the longevity of binding materials be undertaken by an independent research laboratory. The Council on Library Resources would be an appropriate institution to organize this effort. Findings would enable development of more precise standards for edition bindings. The following report is not based on the kind of scientific studies that we had for paper, but it is a distillation of experience and advice from knowledgeable people—publishers, librarians, book manufacturers, and manufacturers of equipment and supplies.

We do know that there is a serious problem about binding longevity—or perhaps we should say "binding brevity." Libraries complain that many books fall apart almost before they can get them on the shelves. The problem of deteriorating bindings is not new, but it seems to have increased in recent years, partly because of the widespread introduction of bindings in which the pages are held together by adhesives rather than by sewing as in the past. Today some 80% of

all hardback edition bindings in the U.S. are adhesive bound, and the percentage is increasing.

In this discussion we shall focus on the following desirable characteristics of bindings: *usability* (adequate margins for ease of reading, openability), *durability* (strength), *longevity* (resistance to chemical deterioration), and *repairability* (especially for books expected to be widely acquired by libraries). Our main concern here is longevity, but longevity must be considered in connection with other characteristics, especially durability and repairability. We shall deal first with the inside of the book, sometimes called the textblock (the gathered signatures held together either by sewing or by adhesive), and second with the case and its attachment to the textblock.

I. Pages, F&G's, and Sewing or Gluing.

Pages. If the paper disintegrates, the binding doesn't matter. If the binding falls apart, the book can be rebound—maybe. Rebinding usually encroaches slightly on the inside margins, and if the book is rebound several times it may be impossible to rebind it again without losing some the printing in the gutter. *Therefore we recommend that publishers leave enough inner margins on the printed page (preferably not less than 5/8 inch) so that the book can be rebound if necessary.*

F&G's—Folded and Gathered Sheets. This is the basic inside of the book; the signatures must be bound together to give the book physical integrity. This can be done by sewing or by several methods of adhesive binding. How well this is done is the most important factor in determining the longevity of the binding.

Sewing is still considered the best method for longevity and for openability. The thread should be acid-free, usually nylon. If the book comes apart it can be resewn. We regard through-the-fold sewing (Smyth sewing) as preferred. Sewing, however, is more costly than adhesive binding, which is rapidly replacing sewing for edition binding except for certain special-purpose editions. Therefore it is important for adhesive bindings to be strong and long-lasting. Because there are many different types of adhesive and ways of applying them, longevity of adhesive bindings is a complex question.

The adhesives used are mostly petroleum products, plastics, with different constituents and properties. We have not been able to discover any aging tests of adhesives (as we did with paper), and artificial aging by heat is problematic for these materials. We do know that some of the materials, or closely related products, have been used for other purposes requiring great stability, as for spacers in transoceanic cables. So adhesive binding is not necessarily short-lived. Much depends on the particular adhesive used and how it is applied.

The two most widely used categories of adhesives for holding pages or signatures together are the so-called hotmelts and polyvinyl acetate (PVA) emulsions (sometimes called "cold emulsions").

The hotmelts are suitable for paperbacks but tend to become brittle within a

decade, and so are not suitable where longevity is desired. Unfortunately they are also widely used for cheap bindings on hardback books. Hot-melts permit high-speed manufacturing.

The cold emulsion (PVA) adhesives apparently have excellent longevity characteristics; probably they will last longer even than most acid-free book paper. However they have the disadvantage that they take longer to set and thus slow the production process. One widely used method is to apply two shots of adhesive: the first a cold emulsion which holds the book together, and the second a hotmelt to hold the crash.

The preparation of the F&G's to receive the adhesive is important. There are various methods, but in every case the backs of the signatures must be prepared in some way (cut, notched, perforated, burst, etc.) and roughened so that the adhesive can penetrate.

It is appropriate to say something here about paper stock. Uncoated stock (acid-free, we hope) will accept adhesives better than coated stock. Many books, especially expensive art books, are printed on very smooth calendered and coated stock; if the application of adhesive is not exactly right, and if the adhesive and the paper are not a good technical match, the binding will not hold. We believe it is irresponsible to sell expensive art books that are made in this way. In general, adhesives should be chosen in relation to the paper stock used; this is a matter for the binder's expertise. Where longevity is a factor, especially with large and expensive books, sewing is preferred.

We have said that the greatest problem with adhesive bindings, when cold emulsion PVA's are used, is with the application. This may in some cases be related to the high speed of operation of modern binding machinery. The quality of application is the responsibility of the binder, and publishers should insist on high quality. Publishers' production managers should familiarize themselves with binding processes and should inspect the results for quality of application. This usually means extracting a few units from the production line for testing, or destroying a few finished books to test adhesive strength. Binders can produce good bindings if they are required to do so.

II. Book Covers (Cases)

The cover of a hardbound book has several parts (endpapers, crash or gauze, boards, cover material, stamping), and many different types of adhesives are used to glue the parts together (paste, animal glue, a variety of synthetic adhesives). One type of adhesive may be used to tip the endpaper to the text-block, another to glue it to the boards, and still others to hold the cover to the boards or to glue the crash (or gauze) to the backs of the signatures. There are even special flexible adhesives to hold the binding together at the hinges. Formerly most hardbound books were bound in cloth, but today, on account of cost, paper and other substitutes are widely used. We cannot deal with all these matters here, but we do want to offer general observations.

The most important part of the casemaking, for longevity, is the hinge. In

general, if the hinge holds together the book will hold together. The strength of the hinge is determined by the construction of the hinge and by the durability and longevity of the endpapers, the crash, and the cover material. *If publishers would make sure that the textblock is properly sewn or glued, and if they would provide strong hinges, much of the problem of binding longevity would be solved.*

The textblock is attached to the cover by the endpapers and the crash (crash is often omitted in cheap bindings). Acid from acidic endpapers can contaminate the frontmatter and backmatter of books printed on acid-free paper, so acid-free endpapers of appropriate weight in relation to the size of the book should be used. Acid-free endpapers also act as a barrier from the acidic boards. White acid-free endpapers are widely available commercially at costs competitive with comparable acidic endpapers. Nearly all colored endpapers are acidic, but a few manufacturers offer acid-free endpapers in an assortment of colors. Endpapers are glued to the binders boards, often with PVA adhesives but sometimes with paste. Animal glues are widely used in making cases; such glues and paste are unfortunately attractive to insects that attack books. Adhesives should be chosen for flexibility, strength, and longevity. The crash should be acid-free and strong.

Boards. There are two general types of boards, "binders boards" and "chip board." Both are recycled products, made from waste paper, and both are acidic. Fortunately the disintegration of boards does not appear to be a major problem of libraries. Binders board is preferable to chip board because of its strength and resistance to warping. The thickness of the board should be chosen in relation to the weight and size of the book.

Cover material. In recent years cloth has been largely replaced by other materials, just as sewing has been largely replaced by adhesive binding. There are only two major manufacturers of bookbinding cloth in the U.S. today, Joanna-Western and Holliston. A strong woven cloth, we believe, is still preferable to most other materials where longevity is required; it lasts longer and withstands wear better. But there are tremendous differences. Cloth ranges from very weak linen to very strong buckram; costs range proportionately. There has been much controversy over the chemical treatment of cloth. Pyroxylin-treated cloth, widely used in the past, is being replaced by cloth with acrylic coating, which is soil-resistant and should have a long life.

The non-woven covering materials are too numerous and too varied to receive full treatment here. Some are very poor, consisting of kraft paper (acidic) with a chemical coating, for example; often such materials are made with a texture to imitate cloth. Fortunately there are also excellent tough long-lasting non-woven materials (Type III synthetic fiber materials, such as Tyvek). For longevity and durability some Type II materials (polymer or resin reinforced paper) may also be satisfactory.

If a full cloth or Type III binding is too costly, a good compromise is a three-piece binding with cloth on the spine and Type II non-woven material over the boards.

Summary and Recommendations

I. The inside of the book ("textblock")

1. Leave at least 5/8-inch inside margin.
2. Sewing through the fold (Smyth) is preferred.
3. For adhesive bindings use a cold emulsion PVA or a cold plus hot (two-shot) method. Do not use a hotmelt alone.
4. Much depends on the quality and method of application of adhesives and on the compatibility of materials. Work with your binder and test the results.

II. Book covers (the hinge is critical for durability and longevity)

1. Use strong acid-free endpapers (80 or 100 lbs.).
2. Use strong acid-free crash.
3. Cloth covers are preferred; use a grade of cloth appropriate for the size and weight of the book.
4. Non-woven covers of Type II and better are satisfactory, especially if chosen with durability and longevity in mind. A 3-piece cover with a cloth spine is a good compromise.
5. The grain of the cover material, boards, and endpapers should run parallel to the hinge, to minimize warping.
6. Binding is an art. Use a good binder who can match the adhesives to the material and who will provide high quality workmanship.